Molten Salt Oxidation Technical Overview

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Program Objectives

- Stabilize ^{238}Pu-contaminated combustible waste
- WIPP waste acceptance criteria compliance
- Recover ^{238}Pu
- Technology deployment
- Waste volume reduction

Benefits

- Removes combustible component of ^{238}Pu-contaminated wastes
- Recovery of ^{238}Pu for reuse in heat source operations
- Significant reduction of the volume of TRU waste requiring disposal
- Legacy and newly generated waste disposal cost savings

^{238}Pu-Contaminated Materials

- Polypropylene (PP) bottles
- High density polyethylene (HDPE) bottles
- Gloves
- Bagout bags (PVC)
- Tygon™ tubing
- Cheesecloth wipes (cotton)
- Pyrolysis ash
- Non-RCRA organics

Combustible Materials

Molten Salt Oxidation (MSO)

- Hydrocarbons react with oxygen to form H_2O and CO_2
- Molten salt (e.g., Na_2CO_3) serves as a catalyst for the oxidation reaction
- Temperature of reaction: 900°C
- No open flame
- Acidic species such as F, Cl, Br, I, S, and P react with Na_2CO_3 to form neutralized salts
- Metal species are retained in the molten salt as metal oxides or salts

MSO Process Design

- Mature waste treatment technology
- Rapid implementation
- Solid and liquid materials can be treated
- Inorganics retained in ash
- Low pressure
- TransOx™ system compatible with glovebox operation
- Semi-batch process

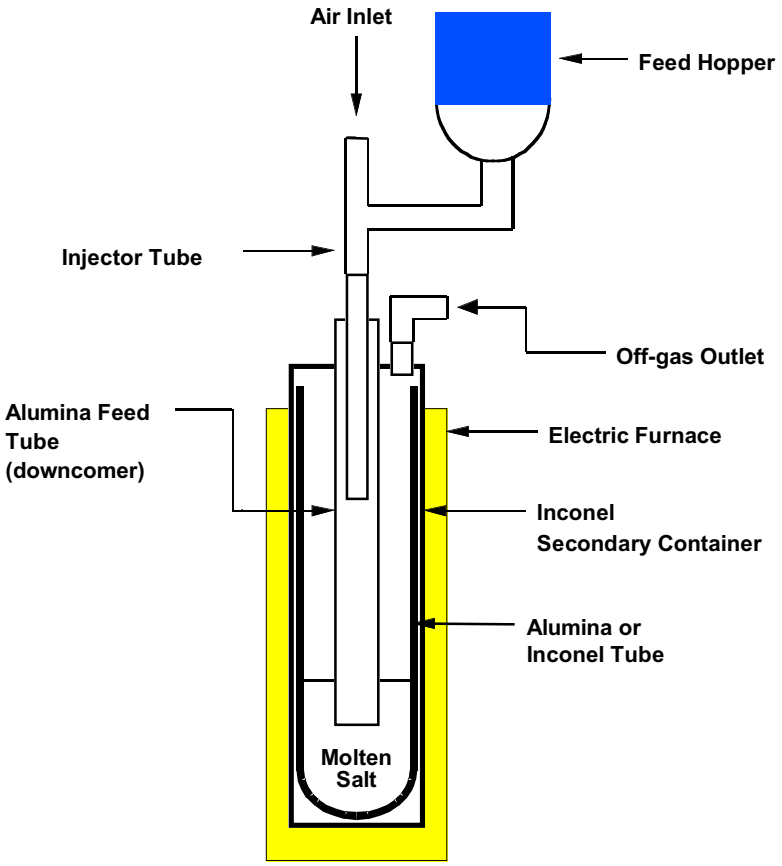
MSO Process Design - continued

- Safe operation and minimal handling of ^{238}Pu-contaminated materials
- Throughput of 2 kg/hr
- Minimal feed pretreatment
- Minimal treatment of offgas and waste
- Reduction of TRU waste volumes
- Salt recycling with ^{238}Pu recovery by aqueous processing

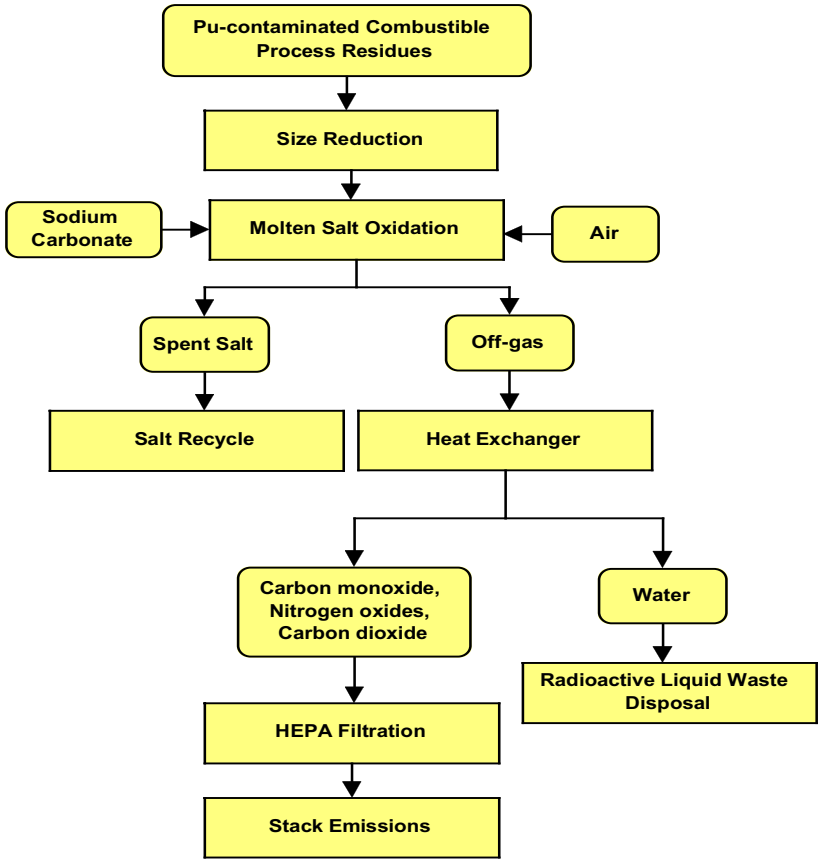
MSO Process Limitations

- Maximum concentration of ash: 20 wt. %
- Maximum concentration of neutralized salt: 95 wt.%
- Removal of spent salt is required to maintain continuous operation
- Limited to treatment of combustible wastes
- Corrosion
- Size

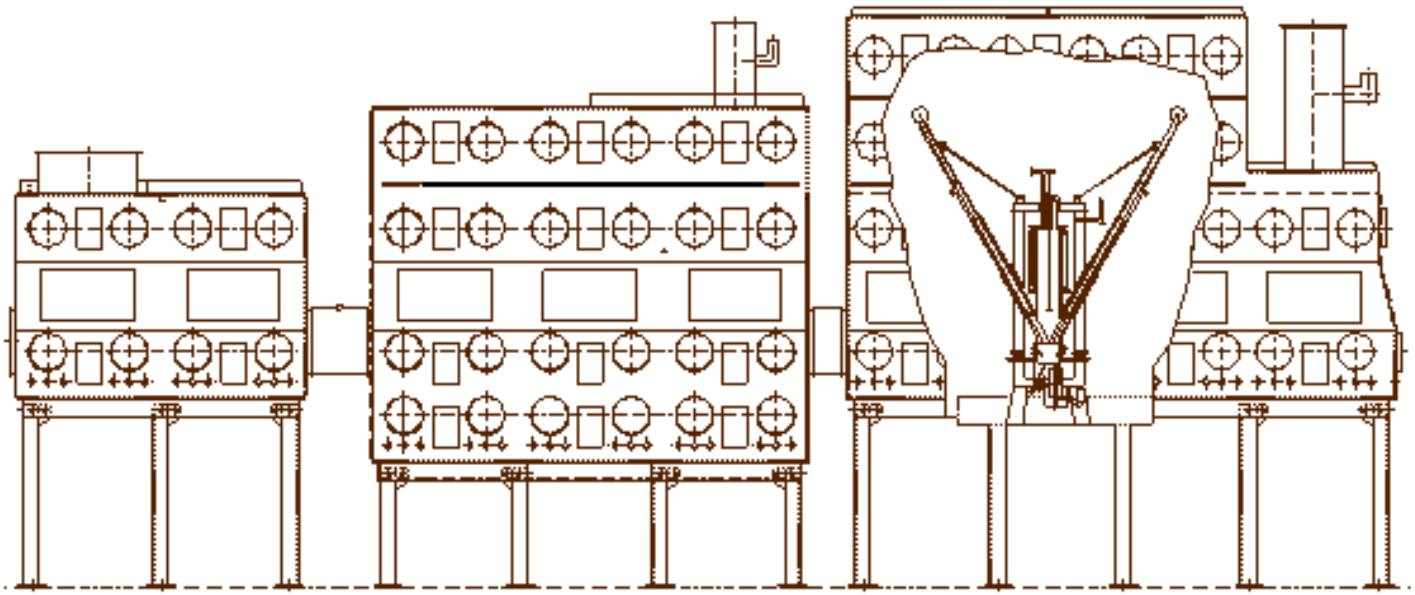
Traditional MSO Reactor



Molten Salt Oxidation Process



MSO Process Line



Pretreatment

- Size reduction required for solids
  - 0.95 cm (0.375 inch) material size
  - Granulation technology (Rapid Granulator, Inc.)

Size Reduction

Size Reduction

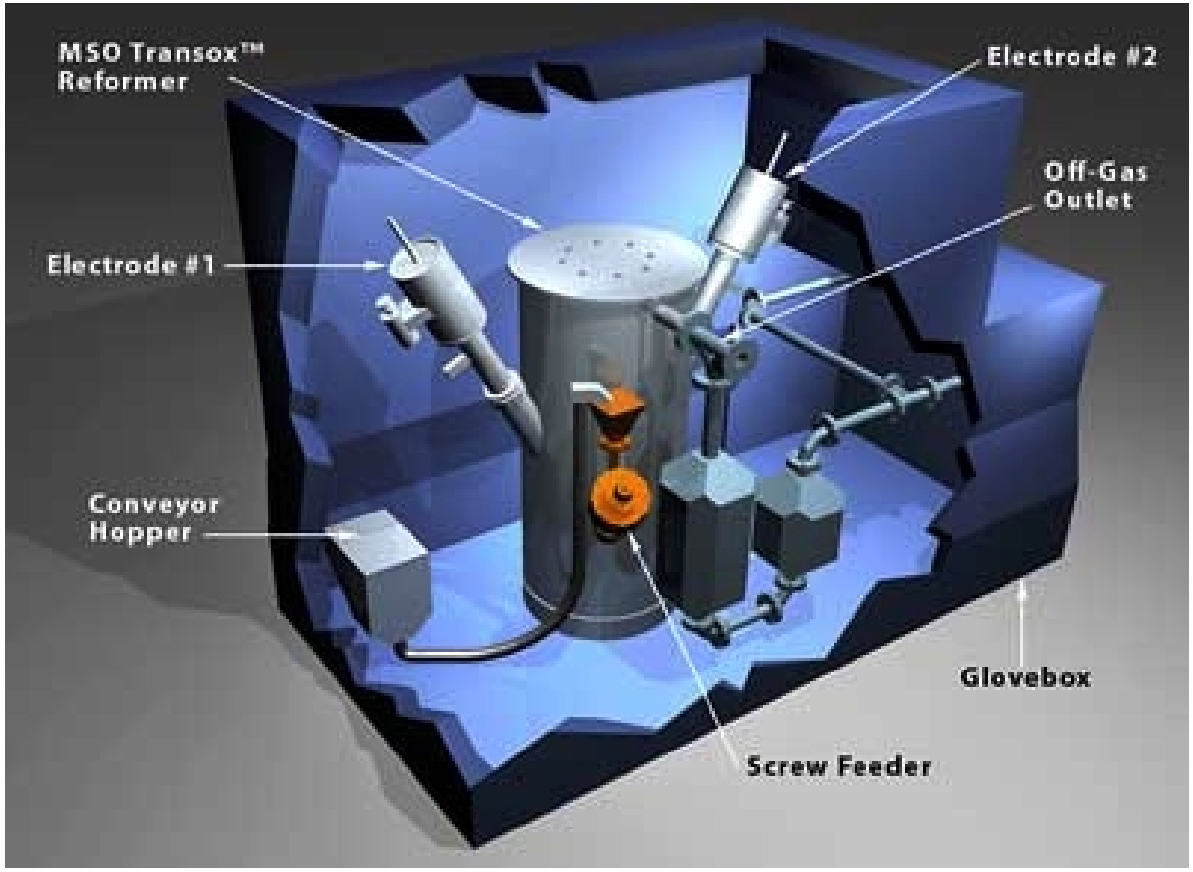
TransOx™ System

- Aluminized Inconel 600 construction
- Internal heating/external cooling
  - Better temperature control
  - Increased energy efficiency
  - Increased throughput
- “Skull” layer of salt
- Salt drain system
- Automated operation

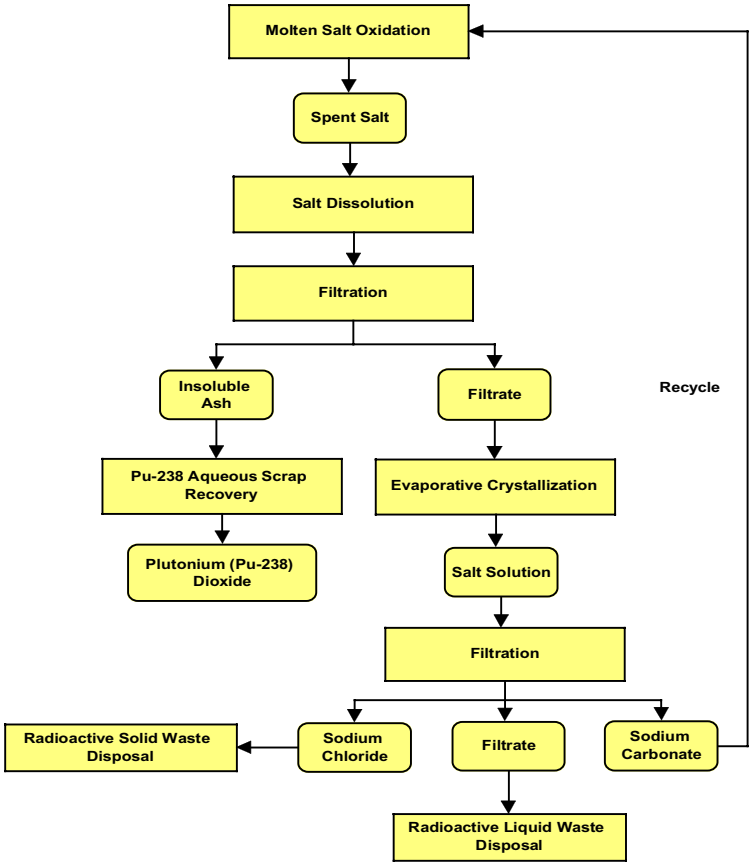
TransOx™ System

- Minimal salt/metal contact
- Extended vessel life
- Decreased maintenance
- Continuous operation not required

TransOx™ System



Salt Recycling Process



Surrogate Materials Results

Material	% Cl	Destruction Efficency
Polypropylene (PP)	0	99.998
High Density Polyethylene (HDPE)	0	99.983
Gloves	0	99.997
Tygon Tubing	30	99.999
Pyrolysis Ash (9% wt. in ethylene glycol)	0	99.987
Ethylene Glycol	0	99.999
Bagout Bags	36	99.988
Homogenized Mixture	20.5	99.974
Average		99.991

NSWC-IH

Milestones

- Complete equipment and glovebox design (09-30-99)
- Complete procurement of major equipment and gloveboxes (01-30-00)
- Complete installation of equipment and gloveboxes (09-30-00)
- Begin processing legacy waste (09-30-00)

Deployment Opportunities

- Los Alamos National Laboratory
  - Chemistry and Metallurgy Research Facility
- Savannah River Site
- Rocky Flats Environmental Technology Site

Legacy Waste

- 7500kg of ^{238}Pu-contaminated combustible waste in storage at TA-54 and TA-55
- No treatment/packaged to meet WIPP requirements
  - 8700 drums/1831 m^3
- MSO treatment/no ^{238}Pu recovery/WIPP disposal
  - 420 drums/88 m^3
- MSO treatment/aqueous recovery of ^{238}Pu/WIPP disposal (50% process efficiency for aqueous recovery)
  - 190 drums/ 40 m^3

MSO Web Site

http://www-emtd.lanl.gov/ASTD-NM/MSO.html